

Lakeland Community College COURSE SYLLABUS

WELD 1340 Basic FCAW (Flux Cored) and GMAW (MIG/MAG) Welding 3 credits

Lecture

Lab

Instructor: NAME OF INSTRUCTOR

Contact: Email: alternate:

Phone: cell: alternate:

Textbook Required:

HELP/TUTORING:

Available at the Learning Center Office, Rm A1044 Phone 525-7019

COURSE DESCRIPTION:

This course introduces students to the basic concepts of utilizing the Flux Cored Arc Welding (FCAW) and Gas Metal Arc Welding (GMAW) processes to make fillet and groove welds in the flat and horizontal positions in carbon steel, stainless steel, and aluminum. Laboratory experience includes skill development in both types of arc welding. Students must furnish: welding helmet (shade #10 or above); safety glasses; work gloves; long pants; welding jacket; leather work boots, preferable steel toe; 8" crescent wrench; soapstone and holder; tape measure; combination square; chipping hammer; wire brush; center punch; 12 oz. ball peen hammer; and tool bag. 4 1/2" grinder is optional.

RATIONALE FOR COURSE:

This course provides practical welding experience and knowledge for students wanting to understand and produce fillet and groove welds using Flux Cored Arc Welding (FCAW) with and without the use of shielding gases (FCAW-G or FCAW-S) and Gas Metal Arc Welding (GMAW) in the flat and horizontal positions. This course will provide a pathway for employment in a welding field and for welding certification.

COURSE OBJECTIVES, at the conclusion of this course, the student should be able to:

1. Identify and apply safety procedures when working with welding equipment.
2. Produce acceptable FCAW-G and FCAW-S welds in: T-, butt and lap joints in mild steel and stainless steel.
3. Produce acceptable GMAW welds in: T-, butt and lap joints in aluminum, mild steel, and stainless steel.
4. Name and describe the function of each major component of a wire-feed welding machine.
5. Troubleshoot the FCAW-G, FCAW-S and GMAW machines and processes to ensure proper settings and production of quality weldments.
6. Demonstrate proficiency in using the FCAW-G and FCAW-S processes to make welds in the 1F, 2F, 1G & 2G positions that meet AWS D1.1 visual inspection standards.
7. Demonstrate proficiency in using the GMAW process to make welds in the 1F, 2F, 1G & 2G positions that meet AWS D1.1 visual inspection standards.

COURSE OUTLINE

- I. Safety
 - A. Proper Protective equipment
 - B. Hazards

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- C. Handling the gas cylinders
 - D. Electrical shock
 - E. Arc Ray
 - F. Burns
 - G. Clean Shop environment

II. GMAW Fundamentals and Conventional Modes of Transfer

- A. Short circuiting transfer
 - 1. Characteristics
 - 2. Polarity
 - 3. Inductance
 - a. Pinch and arc Control
 - 4. Types of gases and there uses
 - a. Inert and Active
 - 5. Positions
 - 6. Voltage
 - 7. Wire feed speed
 - 8. Advantage and limitations
 - 9. Techniques
- B. Globular transfer
 - 1. Characteristics
 - 2. Polarity
 - 3. Gases
 - 4. Voltage
 - 5. Wire Feed speed
 - 6. Position
 - 7. Technique
 - 8. Advantages and disadvantages
- C. Spray transfer
 - 1. Characteristics
 - 2. Polarity
 - 3. Gases
 - 4. Voltage
 - 5. Wire feed speed
 - 6. Position
 - 7. Technique
 - 8. Advantages and Disadvantages

III. GMAW Fundamentals - Pulsing and Waveform Control Technology

- A. Pulse
 - 1. Polarity
 - a. DC+
 - 2. Gases
 - a. Transition current 80% Rule
 - b. 90/10, 98/2, 95/5
 - 3. Maximum amount of oxygen allowed in Mixed gases
 - a. 5%
 - 4. Trim VS Volts
 - 5. Different waveforms
 - 6. Setting up and programing the welding Machine
 - a. Front panels
 - i. .035 AR/CO2 program #11 350 MP
 - 7. Pre-flow
 - 8. Post flow
 - 9. Run-in
 - 10. Start control
 - 11. Arc control

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12. Burn back
 13. Spot timer
 14. Cold feed
 15. Purge
 - B. Modified short circuiting transfer (STT, PipePro, etc)
 1. Peak
 2. Background
 3. Tail-in
 4. Tail-out
 5. WFS wire feed Speed
 6. Voltage
 - a. Advantages and Disadvantages
 - b. Gases
 - c. Wire Size

IV. Power Sources - (Typically Same for GMAW and FCAW)

- A. Constant Voltage compared to Constant current
- B. Duty Cycle
 1. Percent of time machine can operate as rated in 10 minute period
 2. 30% for machine rated at 250 amps = 3 min in any 10min period

V. Wire Feeders- (Typically Same for GMAW and FCAW)

- A. "Smart" Feeders
- B. "Dumb" feeders
 1. Drive motors
 - a. 2 roll systems
 - b. 4 roll system
 - c. V-groove, U-groove and knurled drive rolls
- C. Single vs dual-wire feeders
- D. 2 drive rolls vs 4
- E. Cold feed
- F. Gas purge
- G. Volt control
- H. Wire feed speed control
- I. Control cable receptacle
- J. Wire drive systems
- K. Wire wheel spindle and adapter
- L. Wire guides or guide tubes

VI. Gun and Cables - (Similar for GMAW and FCAW-G, FCAW-S Slight Gun Difference)

- A. Amperage range
 1. 100 to 500
- B. Parts of a gun and cable
 1. Trigger
 2. Liner
 3. Gas diffuser
 4. Nozzles
 5. Contact tube
 6. Differences in guns used for FCAW-S

VII. Shielding Gas

- A. Carbon Dioxide
 1. Low cost

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- 2. less spray transfer
 - 3. Less radiated
 - B. Argon/Carbon Dioxide
 - 1. Low spatter
 - 2. Better mechanical properties
 - 3. High deposition rate
 - 4. Less penetration

VIII. Electrodes and AWS Numbering System - Applies to Both GMAW and FCAW

- A. Solid and tubular electrodes
 - 1. GMAW uses solid or metal-core tubular
 - 2. FCAW uses flux-cored tubular
- B. ER70S-6
 - 1. E= electrode; R=filler rod
 - 2. 70= minimum tensile strength
 - 3. S= solid
 - 4. 6= chemistry
- C. 309L 308L 316L
 - 1. 3= series
 - 2. 09= chemistry
 - 3. L= low carbon
- D. 4043 5356
 - 1. 4= series
 - 2. 043= chemistry

IX. Trouble Shooting

- A. Welding application

X. FCAW-S Fundamentals - (Similar to GMAW Except for Following)

- A. "Innershield" welding
- B. Tubular wire - primary difference is chemistry: has more de-oxidizers
- C. Polarity sensitive wires - GMAW typically DC+ (DCEP)
 - 1. DC-
 - 2. DC+

XI. Flux Core Self-shielded Advantages

- A. Outdoor welding
- B. Minimizes restarts
- C. No shielding gas required
- D. Deposition rate are very high

XII. Flux Core Self Shielded Limitations

- A. Smoke fumes - more fume is produced
- B. Spatter
- C. Slag

XIII. Electrical Stick-Out Vs Visible Stick Out - (Applies to Both GMAW and FCAW)

- A. From the end of the electrode to the molten puddle
- B. From the end of the nozzle to molten puddle

XIV. Equipment and Setup - (Almost Identical for Both GMAW and FCAW)

- A. Gun & cable
- B. Contact tip
- C. Drive motor
- D. Local and remote
- E. Wire speed receptacle
- F. Amps volt meter

XV. Trouble shooting

- A. ESO = Electrical Stick out
- B. Too Short
 - 1. Porosity
- C. Too long
 - 1. Ropey and too cold
 - 2. Decrease penetration
 - 3. Increase spatter

XVI. Core Elements in the Wire - (Effects Are Similar for Both GMAW and FCAW)

- A. Aluminum
 - 1. Deoxidizer & denitrify
- B. Calcium
 - 1. Provides shielding and forms slag
- C. Carbon ETC.
- D. Function of core elements
 - 1. Mechanical properties
 - 2. Metallurgical properties

FEDERAL CREDIT COMPLIANCE STATEMENT:

It is expected that students will spend two to three hours, minimally, outside of the classroom/laboratory performing course related work such as reading, research, homework assignments, practice, studio work, and other academic work for every hour of instruction spent in the classroom/laboratory.

STUDENTS WITH DOCUMENTED DISABILITIES:

Lakeland Community College is committed to providing all students equal access to learning opportunities. The Student Accommodation Center works with students with documented disabilities to provide and/or arrange reasonable accommodations. If you have a disability (e.g. learning, attention, psychiatric, vision, hearing, physical, or systemic) and feel it may create a barrier to your education, contact the Student Accommodation Center at 440-525-7020 or stop by the office, Room A-1042.

SUBSTANCE ABUSE NOTICE:

The Lakeland Community College Welding Program is committed to a safe learning environment in the classroom and the laboratory. Students are expected to report to lecture and lab classes properly prepared and unimpaired by alcohol and/or drugs. If the instructor believes a student is under the influence of alcohol and/or drugs, the instructor will ask the student to leave the classroom to ensure the health and safety of all students. Any student asked to leave the classroom faces potential Student Conduct Code charges.

ACADEMIC INTEGRITY:

Honesty, as the basic component of trust is essential to both individual and institutional integrity. With this premise in mind, Lakeland Community College has set forth certain behaviors as being forms of academic misconduct, and thus potentially diminishing Lakeland's integrity, reputation for academic quality, and ability to function as an academic

community. The institution's faculty and administration, therefore, regard academic misconduct as a serious offense. Established as violations of academic misconduct at Lakeland Community College are cheating, plagiarism, fabrication of material included in academic work, denying others access to information or material, enabling academic misconduct, and deception in order to gain academic advantage. Policies dealing with violations of academic misconduct may be obtained by visiting <http://www.lakelandcc.edu/web/about/student-development> or from the Student Development Office.

GRADING:

The final grade for this three-credit hour course will be calculated based on scores achieved on attendance, homework, quizzes, a midterm exam and a final exam. The instructor has the option of grading on a curve if the average grade is less than 80%.

91 – 100%	= A	BASIS FOR GRADES:
83 - 90.99%	= B	Attendance (Missing 20% of classes = 0) --- 20%
75 – 82.99%	= C	Homework ----- 10%
68 – 74.99%.....	= D	Laboratory Assignments-----15%
67.99 or below	= F	Quizzes ----- 10%
Failure, non-attendance	= FNA	Midterm ----- 20%
		<u>Final Exam ----- 25%</u>
		Total --- 100%

ATTENDANCE (20% of final grade):

Attendance is a very important part of this course since the Instructor will at times be presenting and explaining information in the lecture sessions that will not be in the text book but may be included in quizzes and exams. Furthermore, employers expect employees to show up on time for every scheduled work day and this attendance requirement is intended to help students develop this ability.

ON THE FIRST DAY OF CLASS: You should make arrangements with two or more classmates so if you are late or have to be absent you can get any missed assignments from them. As you are expected to attend every class it is not the instructor's responsibility or obligation to re-teach material to students who are absent.

IF YOU ARE LATE OR ABSENT: A student can be late for class one time; thereafter, arriving late will count as being absent for half a class. This course consists of 16 classes, so each class missed will reduce student's final course score by 6.25% and missing three classes will result in 20% of students final course score being zero.

LABORATORY WORK/HOMEWORK: (25% of final grade):

Students will frequently be given laboratory work or homework assignments, such as answering end-of-chapter questions or completing an alternate assignment handed out in class, such as measuring lines or distances, creating a 3-view drawing, putting weld symbols on a drawing, etc. Homework turned in late will only get half credit. Students will, however, be given an opportunity to make up lost points by (a) participating in voluntary plant tours or (b) researching the facility offering the tour and then writing a cover letter with a resume applying for employment at that facility and submitting it to the class Instructor or (c) attending an American Welding Society meeting or event.

QUIZZES: (10% of final grade):

Quizzes will not necessarily be announced in advance; therefore, it is important for students to arrive on time for every class. Students who arrive late to class will not be given additional time to complete a quiz. In this course the lowest quiz score will be dropped when the student's course grade is being calculated. Students will not be allowed to make up a missed quiz. The Instructor has the discretion to include pop-quizzes as part of their teaching method and students should be prepared for this to be done in this course.

EXAMS: (Midterm – 25% of final grade; Final – 25%):

Exams will commence and terminate at the pre-announced time. It is the student's responsibility to arrive on time and complete the exam within the stated time. No additional time will be given. If a student is ill on the scheduled Midterm or Final Exam dates, he/she must phone the Instructor at least one hour before the exam is to begin. If you reach voice mail or an answering machine leave a message, clearly stating and spelling your first and last names and provide your

telephone number including area code. In this message, state when you plan to take the missed exam in the Lakeland Learning Center testing room (A-1040). **NOTE: The exam must be taken within 48 hours of its scheduled administration time to avoid penalty unless an alternate time is arranged with the Instructor before the 48 hour deadline has passed.** Students must provide a picture ID for the Testing Center monitor. The student is responsible for determining Testing Center hours.

COURSE POLICY:

The policies and procedures for this course shall be consistent with the college policies and procedures explained in the current Student Handbook and Calendar.

Cell phones are to be turned off or silenced in class and lab, and photographing or video recording of class sessions and/or materials presented is not allowed without the Instructor's permission. Cell phones cannot be used during quizzes or exams, and the Instructor reserves the right to collect and hold them while quizzes or tests are being taken. Non-compliance with this policy may result in a student being expelled from class.

Adds, drops, and withdrawals are per standard policies of Lakeland Community College. A student's failure to attend the class does not constitute a withdrawal and will ultimately lead to a failing grade. Those who wish to withdraw from class should contact the Counseling Center to initiate the withdrawal procedure.

For cancellations due to bad weather, call the Lakeland Emergency Closing Hotline at (440) 525-7242, or check Lakeland's web page, local radio or TV stations.

Methods of Presentation:

Text book reading assignments

Lecture

Audio/Visual Media

Demonstration

On-line presentation

Individualized instruction

The policies, requirements and other information contained in this syllabus are subject to change at the discretion of the Instructor

LAKELAND COMMUNITY COLLEGE'S MISSION STATEMENT:

"To provide quality learning opportunities to meet the social and economic needs of the community."

Lakeland Community College Learning Outcomes Learns Actively Thinks Critically Communicates Clearly Uses Information Effectively Interacts in Diverse Environment Essential skills for personal and professional growth

COURSE SCHEDULE:

Class #	Date:	Topic:	Preparation/Comments:
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The course and services are available without regard to a participant’s race, color, religion, ancestry, age, handicap, sex, marital status or national origin. The number for TDD/TYY or relay services is 440-525-7006.

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